Abstract

In wireless networks, communication takes place over fading channels. In such channels the power is constrained and hencc there is a nced for efficicnt use of power. By varying the transmission rate and power based on the current fading level, a user in a wireless network can more efficiently utilize the available energy. For a given average transmission rate, information theoretic arguments provide the optimal power allocation. However, such an approach can lead to long delays. These delays can be reduced but at the expense of higher transmission power. Moreover, many applications are delay sensitive and hence it can be negelected. The fidelity of the representation of the transmitted source at the receiver directly proportional to the length of the source code and hence there is a trade-off between delay and the fidelity. So, there is a need for adapting the source coding and transmission rates inorder to efficiently control the transmit buffer (and hence minimizing the delay) meeting the constraints of power and message fidelity. In this thesis, the problem of optimal buffer control through joint source and channel coding is addressed.

We consider a problem of optimal source, channel coding rate pair allocation over a wireless link based on the channel fading state and the queue length of the transmitter. The source is delay sensitive. Therefore, our objective is to minimize the mean delay under given mean power and distortion constraints. We show that by jointly optimizing the source and channel rates, one can gain substantially in performance as compared to only source or channel rate optimization, as is usually considered in the literature. This is shown for single user, SISO, MIMO and multiuser systems.